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Smith

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[54] **ADJUSTABLE EARTH-MOVING ATTACHMENT FOR A VEHICLE**

[76] Inventor: **Raymond H. Smith,** Rte.2, 5AAA, Larned, Kans. 67550

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[51] **Int. Cl.**[4] **E02F 5/00**

[52] **U.S. Cl.** ..... **37/108 R;** 37/268; 37/269; 37/273; 37/274; 37/271; 172/787; 172/799.5

[58] **Field of Search** ..... 37/108 R, 108 A, 110, 37/268, 269, 273, 274, 276, 285, 287, 219, 221; 172/786, 787, 799.5, 155, 169, 188, 191, 201

[56] **References Cited**

U.S. PATENT DOCUMENTS

561,988	6/1896	Harmon .	
746,547	12/1903	Miller .	
803,821	11/1905	Grimes	37/269
871,976	11/1907	Whitney .	
964,159	7/1910	Grimes	37/269
1,266,532	5/1918	Mitchell	172/786
1,329,543	2/1920	Northon	172/787
1,331,382	2/1920	Rolland .	
1,354,264	9/1920	Miller	172/786
1,537,091	5/1925	Snyder et al.	37/108 R
1,540,161	6/1925	Callison et al. .	
1,557,035	10/1925	Dost .	
1,575,814	3/1926	Burson	172/786 X
1,719,886	7/1929	Homan	37/281
2,615,264	10/1952	Satterthwaite .	
2,644,252	7/1953	Brown .	
2,749,631	6/1956	Thompson .	
2,806,305	9/1957	Ulrich .	
2,876,852	3/1959	Kenney .	
3,039,209	6/1962	Cron et al. .	
3,195,249	7/1965	Collins	772/786
3,352,036	11/1967	Miller .	
3,424,251	1/1969	Bouley .	
3,435,546	4/1969	Iverson .	
3,471,953	10/1969	Wyatt .	
3,772,804	11/1973	Bomeke .	
3,841,006	10/1974	Mironov et al. .	
4,215,495	8/1980	Wagner .	
7,734,293	2/1956	Barnes	172/799.5

Primary Examiner—Eugene H. Eickholt

Attorney, Agent, or Firm—Litman McMahon & Brown

[57] **ABSTRACT**

An earth-moving attachment for use with a vehicle includes a pair of earth-moving blade assemblies mounted on a main beam. The earth-moving blade assemblies are adapted to be independently movable in several planes with respect to each other and with respect to the main beam so that a plurality of earth-working operations can be performed, and the attachment is amenable for use in conjunction with a wide variety of terrains. The blade assemblies are mounted and designed to efficiently transfer forces with the main beam.

27 Claims, 3 Drawing Sheets

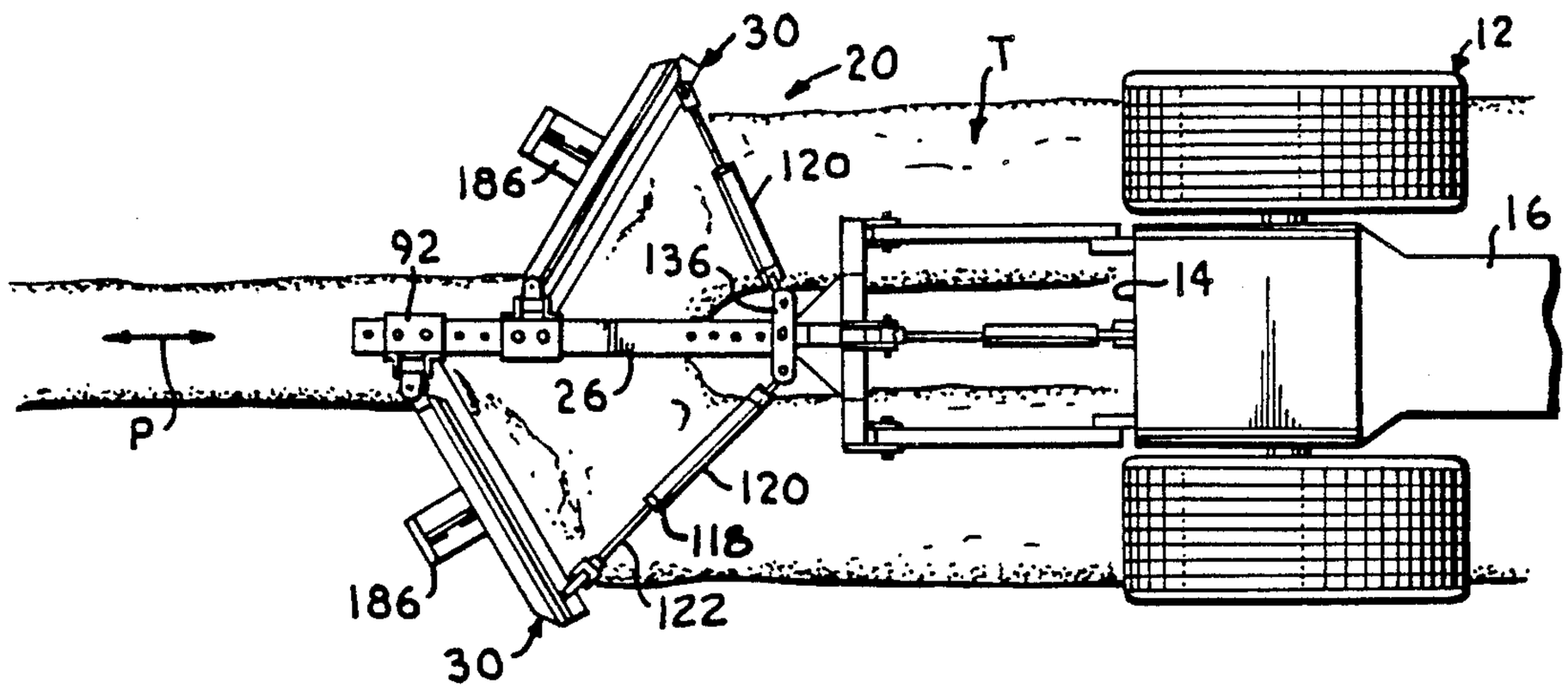
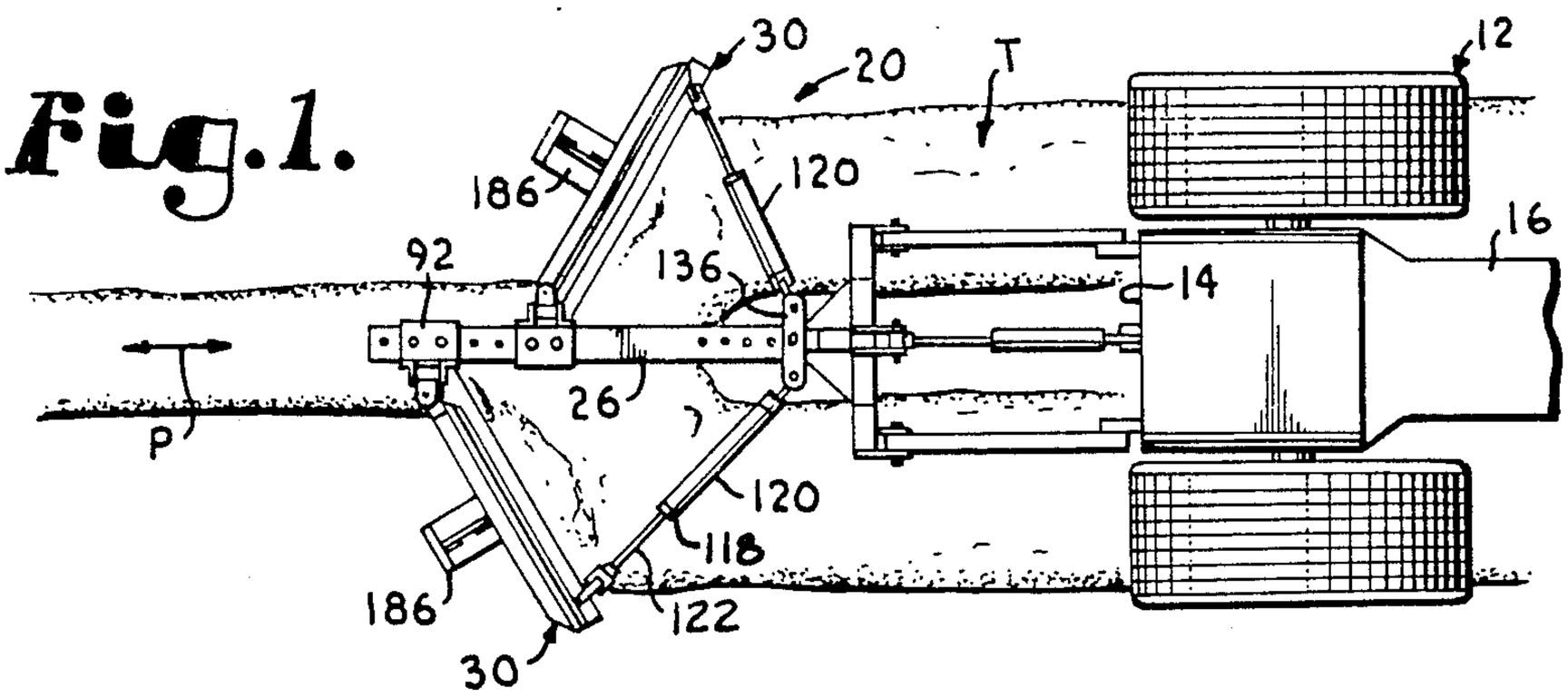


Fig. 1.



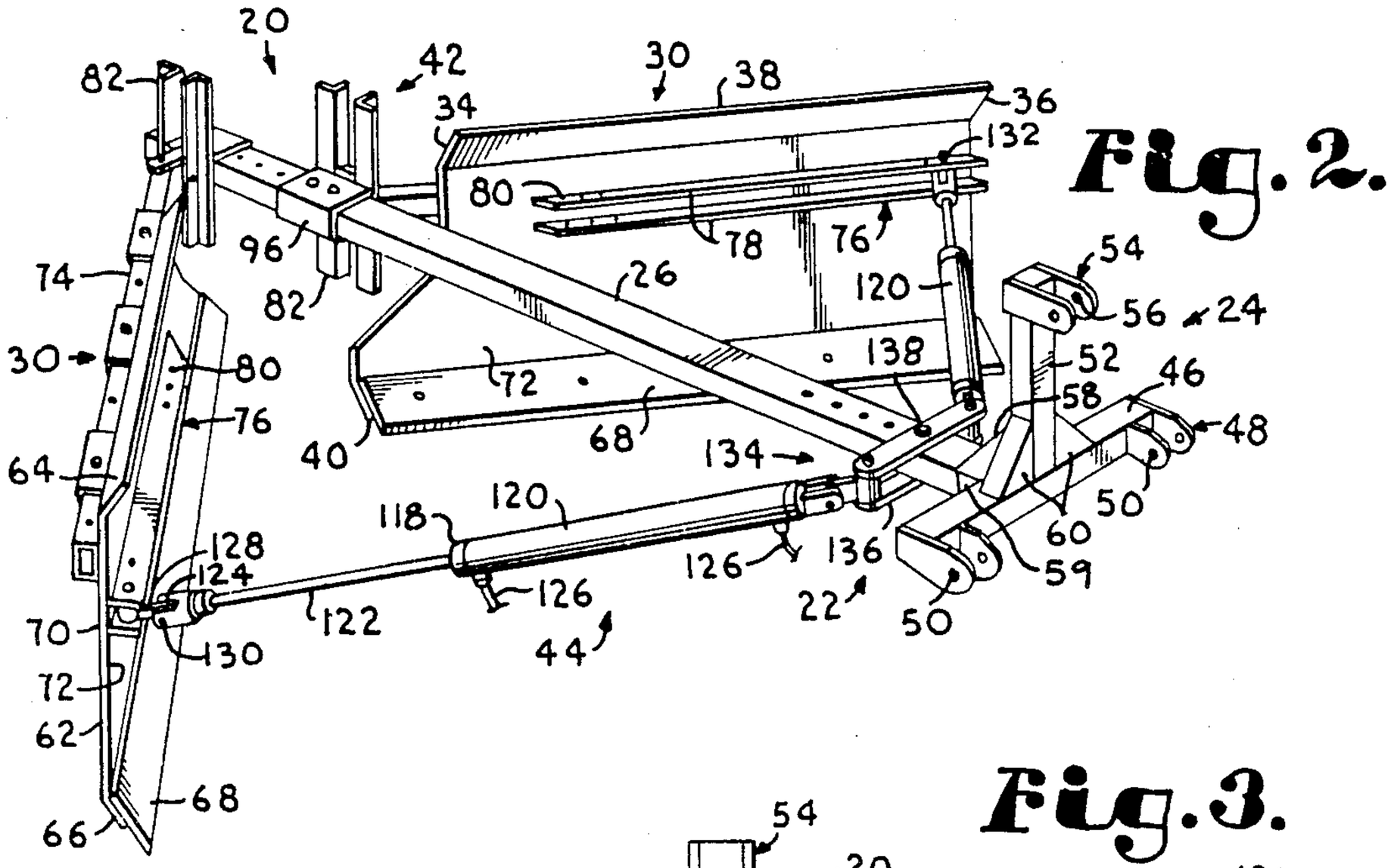


Fig. 2.

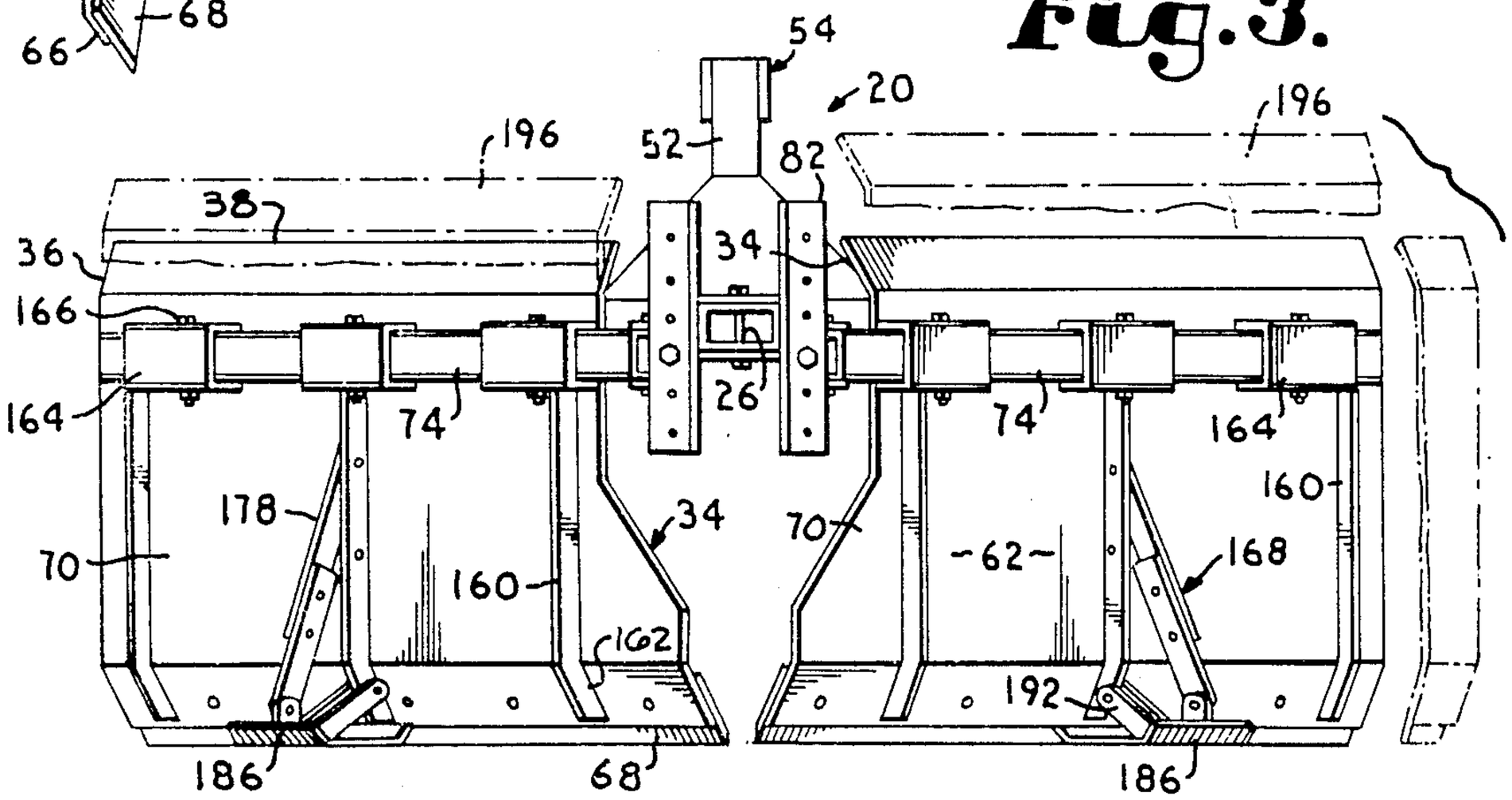


Fig. 3.

Fig. 4.

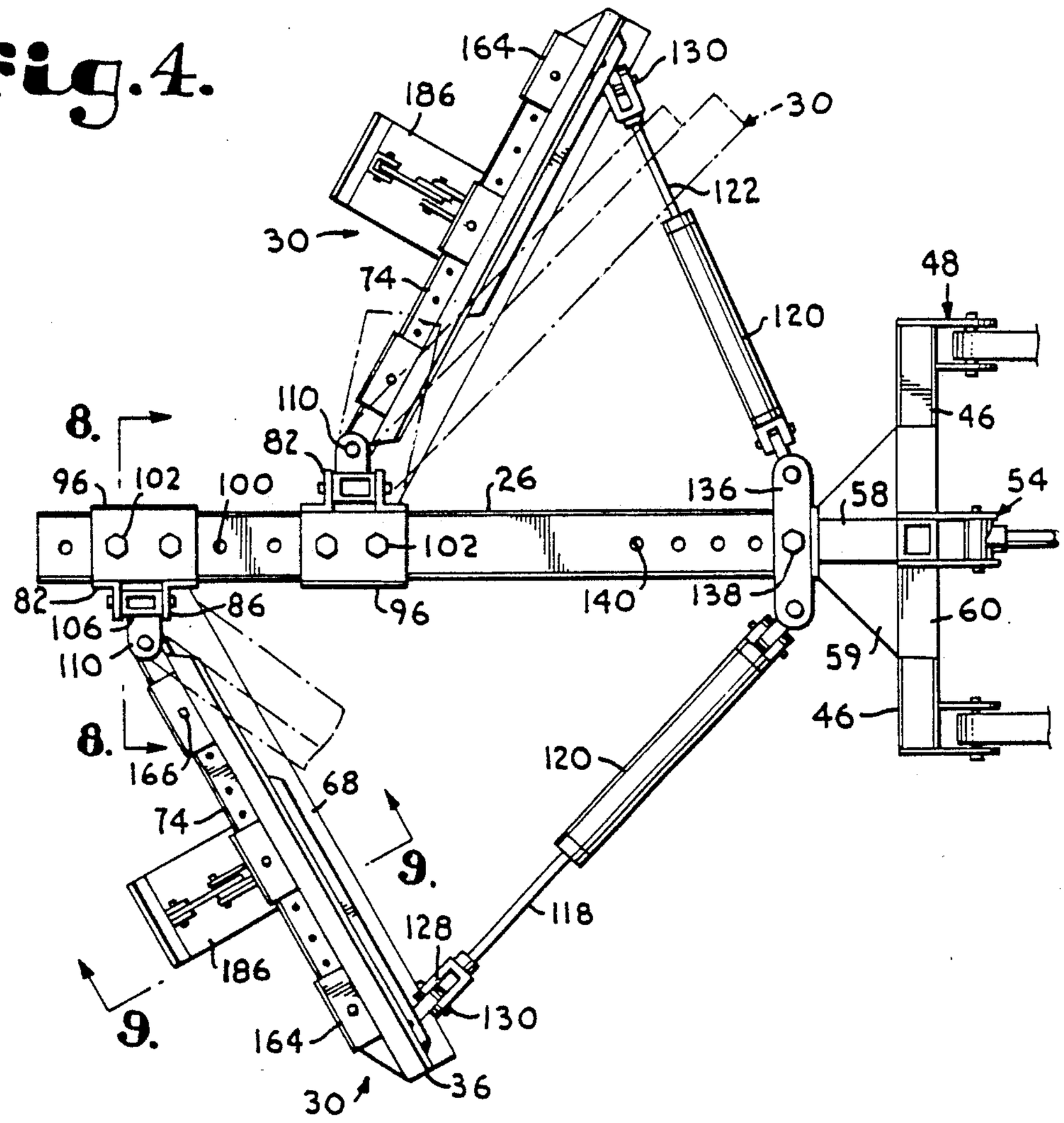

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Fig. 5.

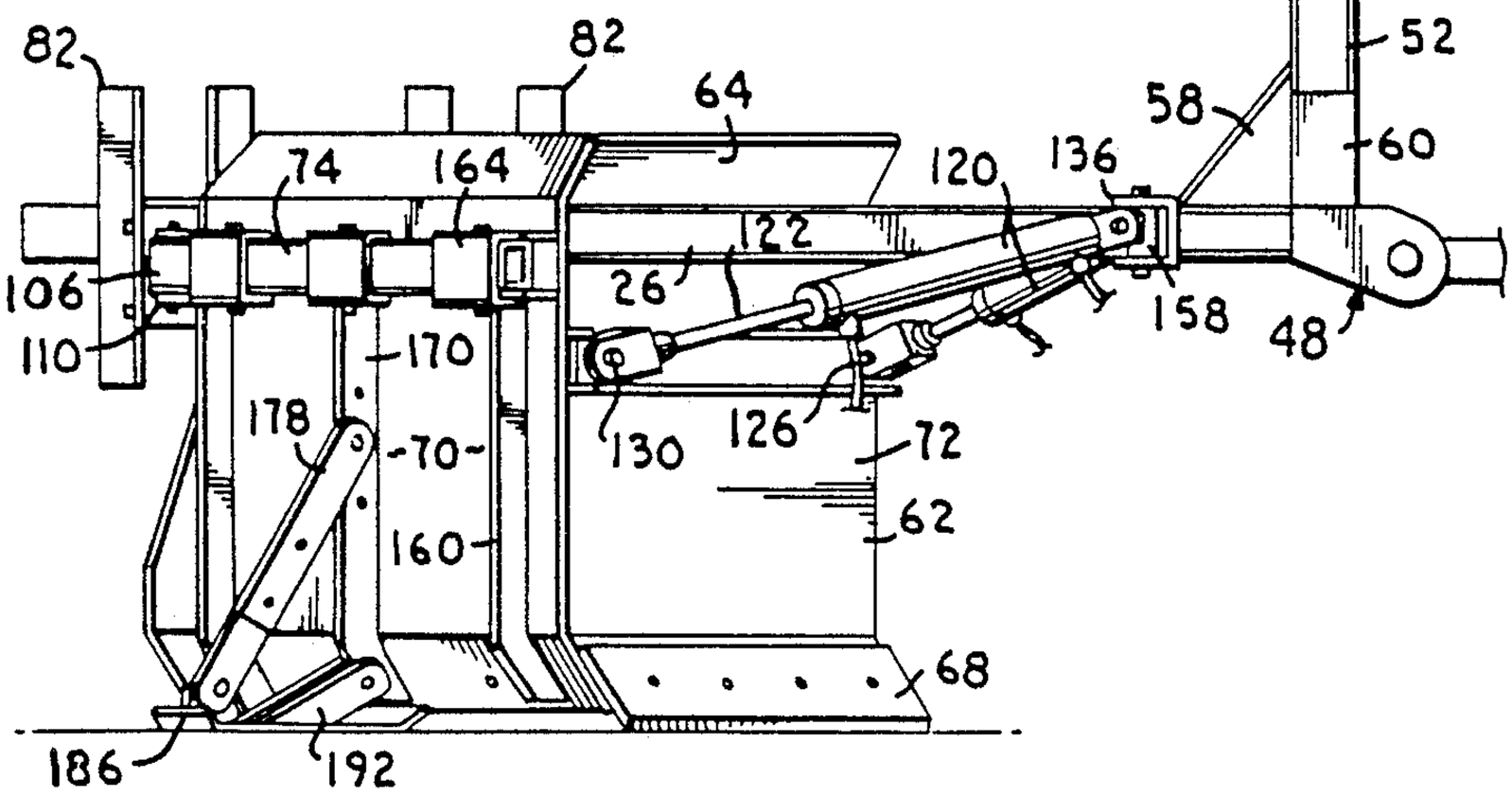
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Fig. 6.

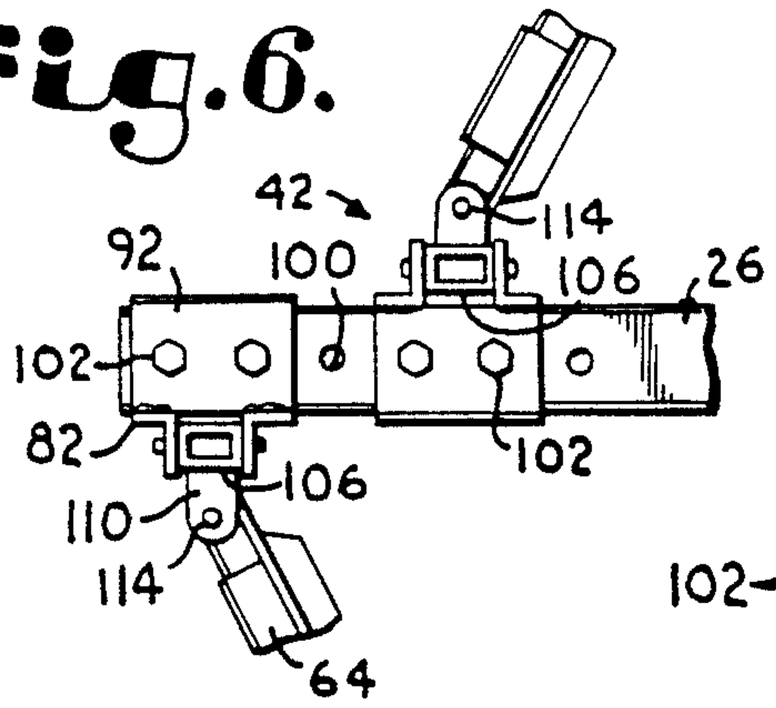


Fig. 7.

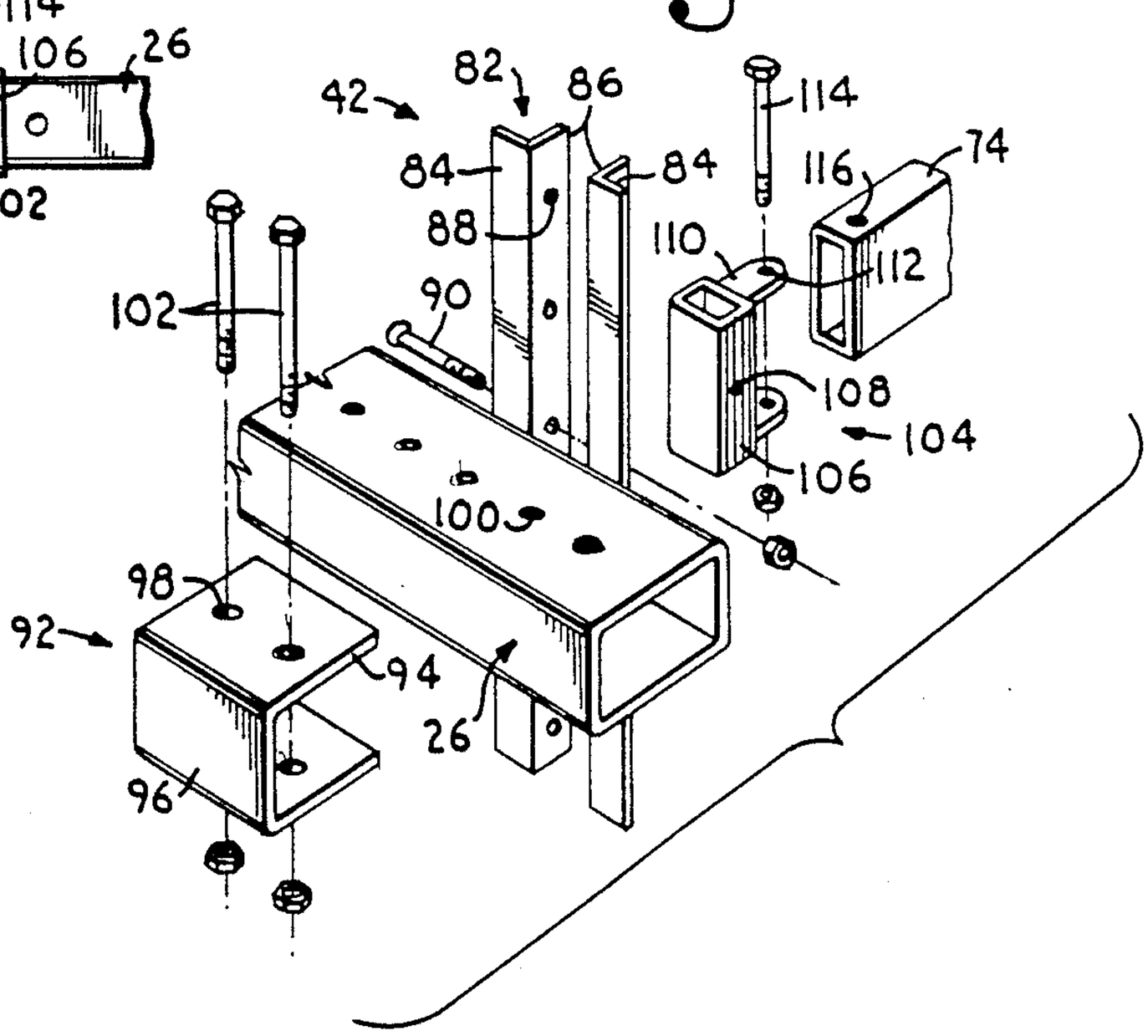


Fig. 8.

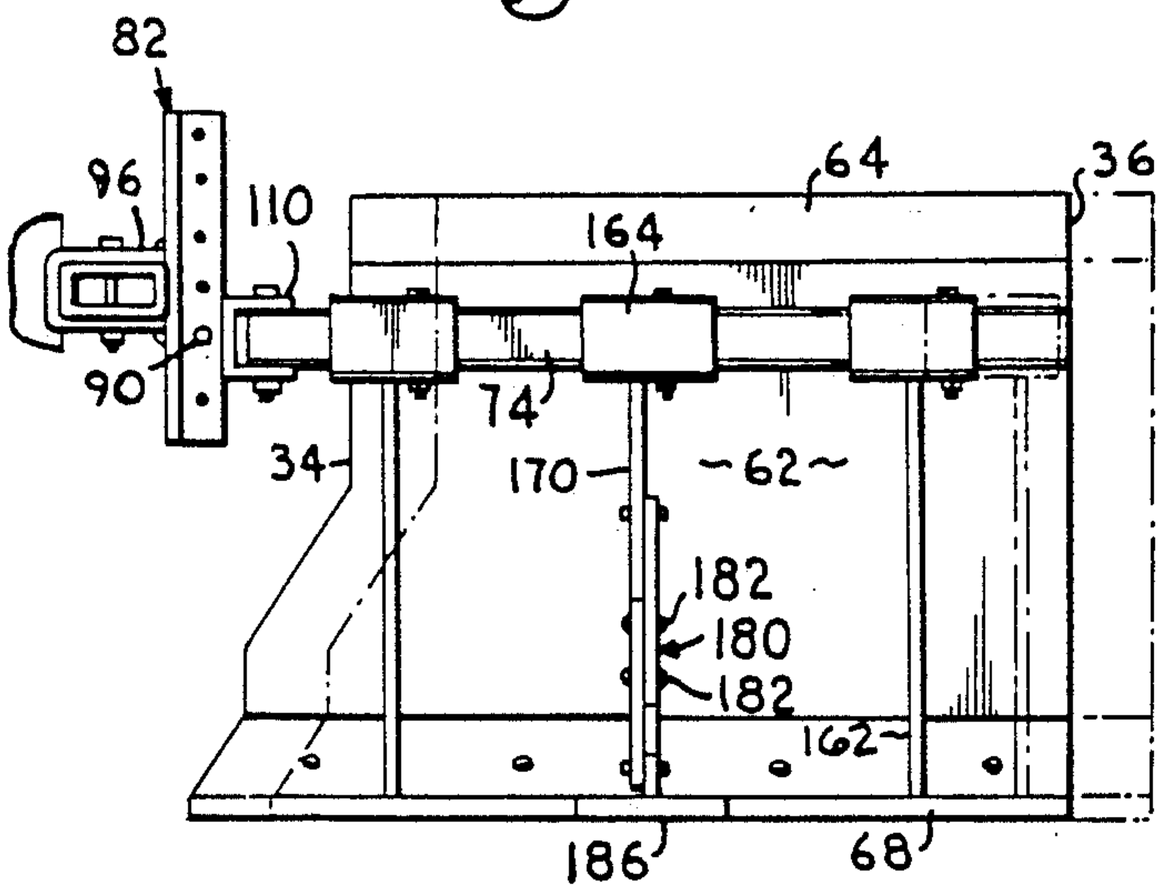


Fig. 9.

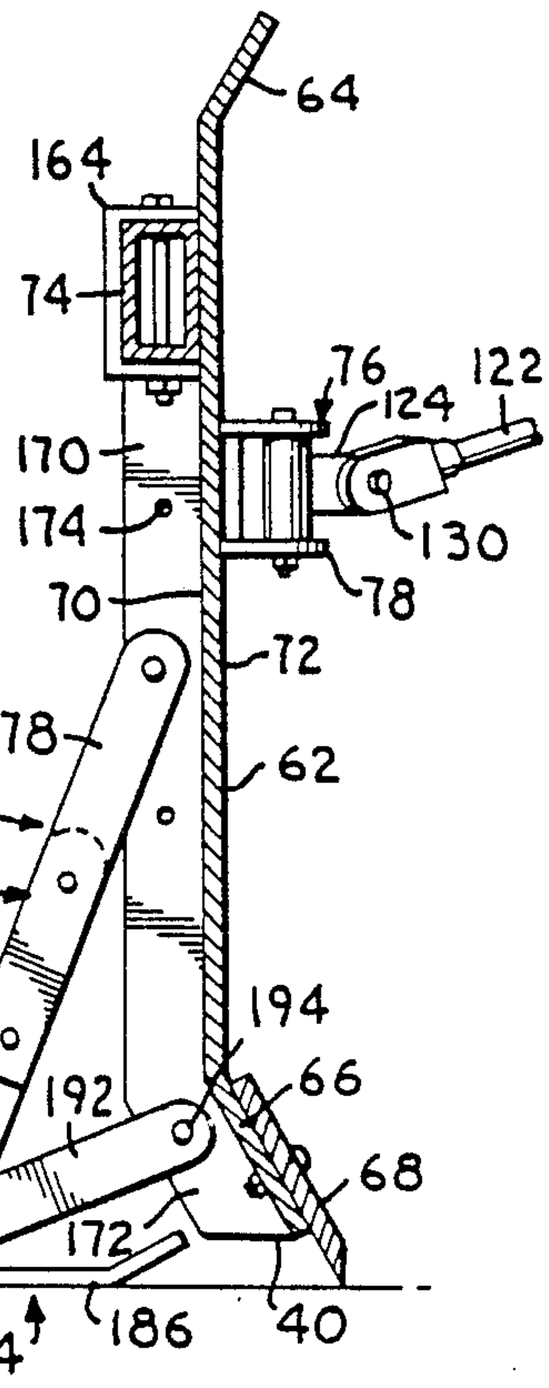
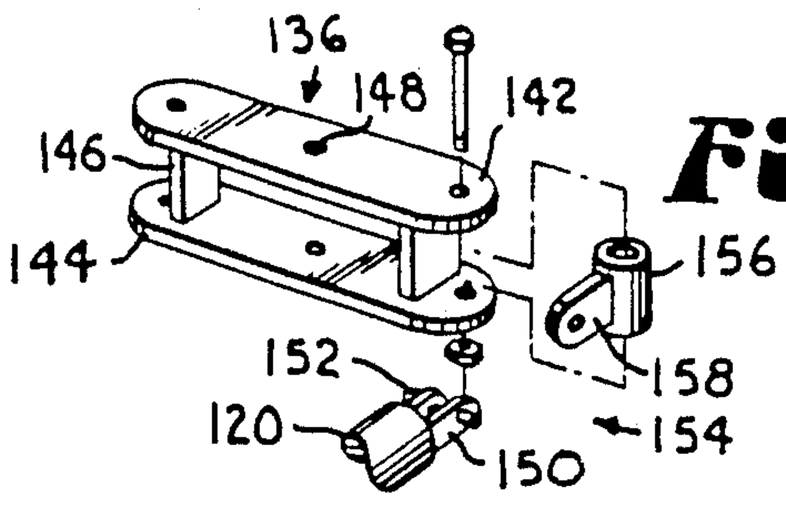


Fig. 10.



ADJUSTABLE EARTH-MOVING ATTACHMENT FOR A VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates, in general, to the field of earth moving, and, in particular, to an earth-moving attachment for a vehicle.

2. Description of the Prior Art

In the field of earth moving, most jobs require specific equipment. For example, the formation of long trenches may require the use of a backhoe; whereas, backfilling may require a bulldozer. This specificity of requirements may make one article of earth-moving equipment so impractical for use in other areas of earth moving as to be nearly unusable except in the particular area for which it is designed. Accordingly, anyone who is required to perform a multiplicity of earth-moving jobs may be required to have access to a large variety of earth-moving equipment. Such a requirement may be quite expensive. Such a requirement may also prohibit a homeowner from performing certain tasks himself, and require him to employ an expensive company to carry out such tasks as landscaping or the like.

However, more serious than simply preventing a homeowner from performing certain tasks, is the drawback of preventing a single company from performing all tasks incident to a single larger job.

For example, in the roadbuilding art, graders are used for fine-grading relatively loose and level earth, and include a leveling blade mounted between the front and rear wheels of a vehicle. Graders are usually large and expensive as they must work large areas. Even though there are many designs intended to make graders more maneuverable with respect to such operations, graders may still not be maneuverable enough to be efficiently and practically applied to other jobs such as terracing or landscaping which might require intricate turns or other such close work.

Furthermore, most graders are large vehicles, and thus, efficient use of forces applied to the earth-moving blades may not be a serious problem, and since the blades of a grader are generally not changed, the ease with which a blade mounting can be changed may not be a primary consideration in the design of graders.

Still further, since the earth-moving blade of a grader is mounted between the front and rear wheels of the vehicle, the design of graders generally does not give primary consideration to whether or not the blades and the mounting therefor are being pushed or pulled.

As discussed above, many earth-moving jobs require an earth-moving blade to be moved along a path having intricate and tight turns and to work in a small area. Accordingly, the blade must be pushed in some locations, and pulled in others if the equipment is to be operated in an efficient manner. Still further, if the earth-moving equipment is to operate efficiently, the angle of attack between the earth-moving blade and the earth should be variable so the blade position can be altered to make most efficient use of the forces exerted by the vehicle which may be in a location relative to the blades dictated by the slope and contour of the terrain worked rather than in a position selected to most efficiently apply force to the blades.

All of the above-discussed drawbacks may prevent a grader from being used to efficiently work earth in many operations, such as excavating a trench adjacent

to a road during preparation of that road, that are associated with road building, which is the primary function of a grader, as well as being applied to other areas, such as the preparation of terraces or tiered banks.

Accordingly, there are other forms of earth-moving equipment, such as plows, or the like, which are generally used to perform tasks requiring a high degree of maneuverability, such as cutting, turning and pulverizing soil in the preparation of furrows and various layers of earth elevations. Such devices are maneuverable, and can have the earth-moving blades easily changed and the angle of attack easily altered. Accordingly, earth-moving equipment such a plow, does not have the above-mentioned drawbacks associated with the lack of maneuverability of large equipment.

However, equipment, such as a plow, is generally not designed to permit the earth-moving blades to operate efficiently in several modes, nor are these blades generally designed to make the most efficient use of the forces applied thereto. Still further, equipment such as a plow, has sacrified its ability to efficiently perform jobs associated with graders and the like in order to efficiently perform other jobs. Accordingly, the problem of specificity is still present, albeit in a different form.

Neither graders nor plows are capable of efficiently pushing material in the manner of a bulldozer. Since many common jobs require the use of a bulldozer, a company or a homeowner may be required to either own a bulldozer or to hire one. In either instance, the cost in time and money is expensive and may be wasteful. However, even further than this, a bulldozer has its own shortcomings that detract from its overall adaptability and versatility. For example, since a bulldozer generally includes a single earth-moving blade, it generally cannot form certain types of terraces or the like in the most efficient manner, and the design of a bulldozer does not need to place primary emphasis on the efficient distribution of forces to and from the blade during use or in the attachment of the blade to the vehicle in a manner that permits easy and rapid movement of the angle of attack of the blade (other than the usual movement associated with the pushing of material) or its removal and replacement.

While none of the presently available earth moving-equipment is extremely versatile, such equipment is still not sufficiently adaptable to be modified to make it more efficient in carrying out jobs for which it was not designed. For example, a grader generally does not have means for readily adapting such device to perform jobs most efficiently performed by a plow.

Therefore, not only does present earth-moving equipment have drawbacks associated with the specificity of the equipment design vis a vis the variety of requirements associated with the earth-moving industry, such equipment has a further drawback in that it is not easily modified to be usable, even in a manner that is not most efficient, to perform jobs for which it was not primarily designed.

Accordingly, there is need for a device which is versatile and can be used for a wide variety of earth-moving jobs and can be used to adapt other earth-moving equipment to perform a greater variety of earth-moving jobs.

OBJECTS OF THE INVENTION

It is a main object of the present invention to provide an earth-moving attachment for a vehicle which can be

used to efficiently perform a wide variety of earth-moving jobs, including more adequately and rapidly filling trenches.

It is another object of the present invention to provide an earth-moving attachment for a vehicle that permits a variety of other earth-moving equipment to be adapted for use in jobs for which such other equipment was not primarily designed.

It is another object of the present invention to provide an earth-moving attachment which is adaptable to make the most efficient use of forces applied to the earth-moving blades.

It is another object of the present invention to provide an earth-moving attachment for a vehicle which is adaptable for use in a variety of modes.

It is another object of the present invention to provide an earth-moving attachment for a vehicle which is inexpensive and can be easily modified.

It is a specific object of the present invention to provide an earth-moving attachment for a vehicle which is amenable for use as a grader, a bulldozer or as a plow and can be used to perform jobs associated with each of these devices.

SUMMARY OF THE INVENTION

These and other objects are achieved by an earth-moving attachment which is adapted to be removably attached to a vehicle such as a truck, a car, a tractor or any other such self-propelled vehicle to be pushed or pulled by that vehicle. The attachment is designed to assume a variety of configurations and to efficiently distribute forces to earth-moving blades in any configuration.

In this manner, the earth-moving attachment embodying the present invention is amenable for use in carrying out jobs heretofore associated only with large equipment, such as graders, yet is also amenable for use in carrying out jobs heretofore associated with smaller equipment, such as plows or backhoes. Thus, the earth-moving attachment of the present invention permits a single vehicle to be used in performing jobs that require many intricate turns and close work, such as the building of terraces, or earth banks, or the like, as well as in performing jobs that require moving large amounts of earth, such as the building of long trenches, or the like.

Accordingly, the attachment of the present invention can be attached to a plow, a bulldozer or a grader to add functions of plowing, to a bulldozer, bulldozing to a plow or to a grader, and the like. For example, a trench can be formed adjacent to a roadbed being formed by a grader using the grader adapted to include the device of the present invention, or a bulldozer can be used to define narrow trenches by attaching the device of the present invention to the bulldozer, or the like.

Specifically, the earth-moving attachment of the present invention includes a main frame assembly having a main beam to which earth-moving blades are movably attached. The blades can be moved in a plurality of planes, including a plane which is upright with respect to the ground being traversed by the vehicle and a plane which is oriented along the ground being traversed by the vehicle. The blades are attached to the main beam to form a closed polygon with the main beam extending along a diagonal of that polygon so that forces exerted on and by the blades are always transferred to the main beam in an efficient manner. The main beam is connected to the vehicle in cantilever fashion by a main beam-to-vehicle attachment means that is adapted to distribute the forces exerted thereon by the main beam in an efficient manner. The main beam is also oriented to accommodate such forces in an efficient manner.

Other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of this invention.

The drawings constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of the earth-moving attachment embodying the present invention mounted on a self-propelled vehicle.

FIG. **2** is a front perspective of the earth-moving attachment of the present invention.

FIG. **3** is a rear elevation view of the earth-moving attachment of the present invention.

FIG. **4** is a top plan view of the earth-moving attachment of the present invention in the FIG. **3** configuration.

FIG. **5** is a side elevation view of the earth-moving attachment in the FIG. **3** configuration.

FIG. **6** is a top plan view of a first blade-to-main frame attaching means.

FIG. **7** is an exploded perspective view of the first blade-to-main frame attaching means.

FIG. **8** is a rear elevation view taken along lines **8**—**8** of FIG. **4**.

FIG. **9** is a side elevation view taken along lines **9**—**9** of FIG. **4**.

FIG. **10** is a perspective view of one element used in a second blade-to-main frame attaching means.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure.

Shown in FIG. **1** is an earth-moving device **10** in the process of filling a trench T. The device **10** includes a self-propelled vehicle **12**, such as a tractor, truck, bulldozer or the like, which is adapted to move in a forward direction or in a rearward direction along a predetermined path as indicated in FIG. **1** by the two-headed arrow P. The device is shown moving in the rearward, pushing mode in FIG. **1**, but can also move in a forward, pulling mode as will be apparent from the ensuing discussion.

The vehicle **12** includes a rear end **14** and a front end **16** as well as appropriate control and motive mechanisms and the like. Those skilled in the art will be able to envision various appropriate vehicles from this disclosure, and thus the vehicle **12** will not be further described.

The device **10** includes an earth-moving attachment **20** which embodies the present invention. The earth-

moving attachment **20** is best shown in FIG. **2**, and attention is now directed to such FIG. **2**.

The earth-moving attachment **20** includes a main frame assembly **22** having a main frame-to-vehicle attaching means **24** on one end thereof and a main beam **26** attached in cantilever fashion at one end thereof to the main frame-to-vehicle attaching means **24**. The main beam **26** is mounted on the main frame-to-vehicle attaching means to have the longitudinal centerline thereof extending along the predetermined path of device movement, either forewardly or rearwardly, depending upon the direction of movement of the vehicle. In a specific application, the main beam **26** can have the longitudinal centerline thereof extending along the centerline of the path of vehicle movement.

The main beam **26** is monolithic, is designed and includes material so that it will efficiently accommodate the forces exerted thereon and transferrred thereto during operation of the device **10** in the manner described below. The beam **26** and the attachment means **24** are also designed and associated with each other and with the vehicle in a manner which efficiently transfers forces to and from the assembly **22** and to and from the main beam during operation of the device **10** in carrying out the various earth-moving operations described and taught below.

The main frame assembly **22** also includes a pair of earth-moving blade assemblies **30** which are identical, and which are each attached to the main beam **26** to be adjustable in a plurality of, and at least two, planes with respect to the path of movement of the device. The blade assemblies **30** are each individually connected to the main beam **26** to be adjustable separately from the movement and adjustment of the other blade assembly thereby making the device **10** able to carry out a wide variety of earth-moving jobs.

Each of the blade assemblies **30** includes an elongate blade **32** having an inner edge **34** locatable adjacent to the main beam **26** in the set-up configuration shown in FIG. **2**, and an outer edge **36** locatable remotely from the main beam **26** in the set-up configuration of the device **10**. Each blade **32** further includes a first edge **38** which is the blade top edge in the FIG. **2** set-up configuration, and a second edge **40** which is the blade bottom edge in the FIG. **2** set-up configuration. As shown in FIG. **2**, each blade inner edge **34** is connected to the main beam **26** by a first blade-to-main frame attaching means **42** to be movable along the longitudinal centerline of the main beam and to be movable in a plane which is upright with respect to the ground, and can be vertical in some instances, and by a second blade-to-main frame attaching means **44** to be movable along the longitudinal centerline of the main beam **26**.

As shown in FIG. **2**, the blade assemblies **30** and the main beam **26** form a closed polygon which can be deformed during use and operation of the device **10** to have the sides thereof form included angles that are all different from each other, and to have the sides thereof all lie in different planes whereby the device **10** can be used in a large variety of configurations to accommodate a large variety of terrains and uses. The main beam extends along a diagonal of the polygon, and since both the inner and outer edges **34** and **36** of each blade are attached to the main beam **26**, all forces applied to and by the blade assemblies are applied to and through the main beam. The main beam **26** can be shaped and sized to adequately accommodate all such forces and the cantilever connection between that main beam **26** and the main frame-to-vehicle attaching means **24** can efficiently transfer forces to and from the main beam and the vehicle **12**.

The main frame-to-vehicle attaching means **24** forms a proximal end of the earth-moving attachment **20**, and is shown in FIG. **2** as including an elongate cross-tongue **46** having attaching lugs **48** on each end thereof. Each attaching lug **48** includes a pair of facially opposed ears having fastener holes **50** defined therein for accommodating fasteners which pivotally connect the main frame assembly **22** to means on the vehicle. The cross-tongue **46** is coplanar with the main beam **26** in a horizontal plane and receives and transmits forces to that main beam. The coplanar arrangement of these two elements permits efficient transfer of forces therebetween.

The attaching means **24** further includes an elongate mast **52** attached to the cross-tongue **46** at a first end thereof to extend upwardly therefrom in the FIG. **2** set-up configuration. The mast **52** includes a second end remote from the first end and having a mast attachment lug **54** having facially opposing ears. The ears include aligned holes **56** which accommodate a fastener for pivotally attaching the mast to means on the vehicle.

The main frame-to-vehicle attaching means **24** includes gussets **58**, **59** and **60** in the connection between the main beam **26** and the cross-tongue **46** and between the cross-tongue **46** and the mast **52** respectively. The gussets **58**, **59** and **60** further reinforce the attachment means **24** and distribute forces therein.

As can be seen, the arrangement and orientation of the various elements of the main frame-to-vehicle attaching means and of the main frame assembly will accommodate and transmit forces in an efficient manner no matter what the orientation of the blade assemblies is with respect to each other, with respect to the ground and with respect to the vehicle.

Each blade **32** is monolithic and includes a planar central portion **62**, a top portion **64** which is angled with respect to the central portion **62** and has the blade top edge **38** thereon, and a bottom portion **66** which is angled with respect to the central portion **62** and which is adapted to mount an appended blade **68** thereon by means of fasteners, such as bolts, or the like. Each blade **32** includes a first surface **70** facing away from the main frame-to-vehicle attaching means **24** and a second surface **72** facing the main frame-to-vehicle attaching means **24**.

Each blade assembly **30** includes a blade extension beam **74** mounted on the blade first surface **70**, and a blade support arm beam **76** mounted on the blade second surface. Both of the beams **74** and **76** extend along the longitudinal dimension of each blade from the outer edge **36** thereof toward the inner edge **34** thereof.

The support arm beam **76** includes a pair of facially opposed elongate elements **78** which have a multiplicity of fastener hole **80** defined therein to be aligned with each other. The purpose and function of the beams **76** and **78** will be apparent from the ensuing disclosure.

The first blade-to-main frame attaching means **42** is best shown in FIGS. **6** and **7**, and attention is now directed to such figures.

Each blade assembly **30** includes a first blade-to-main frame attaching means **42**, and both are identical. Accordingly, only one such attaching means **42** will be discussed. The attaching means **42** includes a pair of elongate L-shaped bracket elements **82**, each having a base **84** adapted to be mounted on the main beam **26** to

be oriented transversely of the main beam longitudinal centerline, and a fastener-receiving leg **86** oriented to extend outwardly away from the main beam. The bracket elements **82** thus extend in a vertical plane in the FIG. **1** configuration of the device **10**. Each of the fastener-receiving legs **86** has a multiplicity of fastener-receiving holes **88** defined therein to be in aligned relationship for receiving fasteners **90**, such as bolts or the like at various positions relative to the main beam **26**. The fastener-receiving legs **86** are spaced apart along the longitudinal centerline of the main beam **26**.

The bracket elements **82** are connected together and are slidably mounted on the main beam **26** by a U-shaped bracket **92** having parallel legs **94** connected together by bight section **96**. The legs **94** are spaced apart a distance sufficient to accommodate the main beam **26** therebetween, and include fastener-receiving holes **98** which are aligned with each other. The main beam includes fastener-receiving holes, such as hole **100**, which are spaced apart along the longitudinal centerline of the main beam. The U-shaped bracket **92** is fixedly attached to the L-shaped bracket elements **82** to define a unitary slide bracket, and the slide bracket is movably attached to the main beam **26** by fasteners **102**, such as bolts or the like received through the aligned holes **98** and **100** to attach the first blade-to-main frame attaching means **42** to the main beam **26** at a selected location.

The bracket **92** thus permits the first blade-to-main frame attaching means to be moved longitudinally of the main beam to adjust the position of the blade assembly associated therewith in a plane that extends along the ground, or in special cases, horizontally. The bracket elements **82** thus permit the blade assembly associated therewith to be moved in a plane that extends upright with respect to the ground, and in some special cases, vertically. The brackets **92** and **82** also permit the inner edges of each of the blades to be spaced apart from each other along the longitudinal centerline of the main beam. In such a configuration, the main beam extends along, not only the diagonal of the polygon formed by the earth-moving attachment, but along one of the sides of that polygon as well. The brackets **92** and **82** thus permit the first blade-to-main frame attaching means **42** to be used to quickly and easily adjust the position of the associated blade assembly in a plurality of planes thereby giving the overall earth-moving attachment **20** a substantial degree of versatility.

The blade associated with each attaching means **42** is attached to the bracket elements **82** by a hinge assembly **104**. The hinge assembly **104** includes a tube **106** adapted to be slidably received between the L-shaped bracket elements **82**, and including a fastener-receiving through hole **108** adapted to receive fastener **90** to attach the hinge assembly **104** to the bracket elements **82**. The hinge assembly **104** further includes a pair of attachment ears **110** having fastener-receiving holes **112** defined therein to be aligned with each other for receiving a fastener **114**, such as a hinge pin, or the like, therethrough for attaching the hinge assembly **104** to the blade extension bracket **74** via a fastener-receiving holes, such as hole **116**, defined in that blade extension beam **74**. The blade assembly **30** is thus attached to the L-shaped bracket elements via the hinge assembly **104** and is hence attached to the main beam to have a plurality of degrees of freedom with respect thereto in a plurality of planes.

As is best shown in FIG. **6**, each blade assembly **30** is individually attached to the main beam **26** by its own separate attachment means, and thus can be moved independently of the other blade assembly. However, the forces exerted on and by the individual blade assemblies are still efficiently transferred to and from the main beam **26**.

The second blade-to-main frame attachment means **44** is best shown in FIG. **2**, and attention is now directed back to such Figure. The attachment means **44** includes an elongate link **118** which is lengthwise adjustable. An example of such an adjustable link is a hydraulic element which is shown in FIG. **2**. The hydraulic element includes a double-acting hydraulic cylinder **120** having a rod **122** extending outwardly therefrom. The cylinder **120** operates on hydraulic pressure in the usual manner, and includes hydraulic lines **126** fluidically attaching the cylinder **120** to a hydraulic system located remotely from the blade assembly, such as on the vehicle **12**, or the like.

The hydraulic cylinder is attached to the associated blade by means of a cylinder-to-blade extension beam attaching means which includes an attaching ear **124** on the cylinder rod **122** and a clevis **128** having a clevis pin **130** which attaches the attaching ear **124** to the blade support arm beam **76**. The clevis **128** is attached to the beam **76** by a fastener **132**, such as a bolt, which extends through the holes **80** in the beam **76**. The clevis is attached to the fastener **132** to be pivotal in a plane which contains the cylinder to move toward and away from the main beam **26**.

The other end of the cylinder **120** is attached to the main beam **26** by a link attaching means **134**. The link attaching means **134** includes a slider **136** mounted on the main beam by a fastener **138**, such as a bolt, extending through a hole in the slider and received in a hole, such as hole **140** defined in the main beam. There are a plurality of holes **140** and all are spaced apart longitudinally of the main beam so that slider **136** can be moved along the longitudinal axis of the main beam to adjust the orientation of the blade assemblies **30**.

The slider **136** and the attaching means **134** are best shown in FIG. **10**, and attention is now directed thereto. The slider **136** includes a first plate **142**, which is the top plate in the FIG. **2** configuration, and a second plate **144**, which is the bottom plate in the FIG. **2** configuration, connected together by side plates **146** which are spaced apart along the lengthwise dimension of the slider a distance sufficient to accommodate the main beam **26** therebetween. The slider includes a fastener-receiving hole **148** which receives the fastener **138** attaching the slider to the main beam.

Each hydraulic cylinder **120** is attached to the slider by a cylinder-to-slider attaching means which includes an attaching ear **150** having fastener-receiving holes defined therein for receiving a fastener **152**, such as a hinge pin, or the like, and a clevis assembly **154** which is mounted on each of the slider side plates **146** in a pivotal attachment. The clevis assembly includes a tube **156** pivotally mounted on an associated one of the slider side plates **146** and an ear **158** having a fastener-receiving hole defined therein for receiving fastener **152** to pivotally attach the clevis assembly **154** to the cylinder attaching are **150** thereby pivotally attaching the slider **136** to the hydraulic cylinder **120** in a manner which permits the link arm **118** to move in a plane containing the main beam **26**. In this manner, the link arms **118** can move toward and away from the main beam **26** to adjust

the orienation of the blade assemblies **30** with respect to each other and with respect to the main beam **26**.

While a hydraulic system is shown as the link **118**, it can also be a mechanical link, such as a jackscrew, a lap joint, or the like without departing from the scope of the present disclosure.

As shown in FIGS. **3** and **8**, the blades can be supported by means such as lateral braces **160** which are mounted on the blade surface **72** and extend from the blade extension bracket **74** to the second edge **40** of the blade. The beam can also include a segment **162** supporting the appended blade **68**, and the beam **74** can include brackets **164** attached to that beam **74** by fasteners **166**.

The blade assemblies can also include additional implements which are attached in outrigger fashion by linkages **168**. Each of the outrigger linkages includes an elongate link arm **170** mounted on the blade and extending from the beam **74** to the second edge **40** thereof, and including an extension **172** associated with the appended blade **68**. Each link arm **170** has a plurality of spaced-apart holes **174** defined therein. A second link arm **176** includes a pair of arms **178** attached together by a lap joint **180** which includes a plurality of fasteners **182**. One end of second link arm **176** is attached to the first link **170** by a fastener extending through the holes **174** and a hole defined in one end of the second link arm **178**. The other end of the link arm **178** has a fastener-receiving hole defined therein.

As best shown in FIG. **9**, one form of outrigger attachment includes a skid **184** having a plate **186** with an attachment ear **188** thereon with a fastener-receiving hole defined therein for receiving a fastener **190** to pivotally attach the skid **184** to the link arm **178**. A further link **192** attaches another part of the skid to the brace extension **172** to attach the skid to the blade in a secure manner. A pivot pin **194** attaches the link **192** to the brace extension.

Other outrigger attachments, such as rollers, upper appended blades **196** (FIG. **3**) or the like can also be used in conjunction with the blade assembly **30** if suitable. Such additional attachments increase the versatility of the device **10**.

As can best be seen in FIG. **3**, the inner edge **34** of each blade is sideways stepped to decline toward the main beam from the first blade edge **38**. This sideways stepping permits the lower marginal portions of the blade inner edges to be located as close to each other as possible to increase earth-moving efficiency of the device, yet will define a spacing between the blade inner edges adjacent to the first blade-to-main frame attaching means **42** to permit the blade assemblies **30** to be moved using such attaching means **42** as above discussed. In this manner, the earth-moving attachment **20** can be easily adjusted, yet can also move the most earth possible.

The operation of the device **10** should be evident to one skilled in this art from the above description. Accordingly, this operation will not be discussed in detail. It is to be noted, however, that, as indicated in FIG. **4**, the blade assemblies **30** can be adjusted independently of each other to assume a variety of orientations with respect to the ground and with respect to each other using the main frame assembly **20** in the manner discussed above. For example, one of the blade assemblies can be on a higher plane than the other blade assembly, and the angular orientation of the assemblies with respect to each other can be adjusted using the main frame assembly **20** in the manner discussed above. It is noted that the angular relationship of the blade assemblies can be adjusted in two planes by means of the first and second blade-to-main frame attaching means. This permits a multi-degree of freedom adjustment of the attachment **20**. It is also noted that in any of the positions of the blade assemblies, the forces exerted on and by the blades are efficiently transferred to and from the main beam and to and from the vehicle due to the relationship of the elements as discussed above.

By attaching the main beam **26** the distal end of the main beam to a vehicle, the attachment **20** can be pulled behind a vehicle. Even in such an operational mode, the forces arising in the attachment **20** are evenly distributed due to the relative orientation of the elements as discussed above.

INDUSTRIAL APPLICABILITY

In addition to the above-mentioned uses for the device **10**, this device can be used in the following situations: to cover ditches with continuous movements; to construct terraces; to construct embankments for various uses; to pile and pack earth works to prevent flooding; in the manufacture of artificial waterways; to bank around railroad tracks and buildings; to produce military embankments; to form banks around trees and plants to retain water; to plant seedlings; to reform and reshape piles of material such as sand and road tar; to evenly pile material; to pile snow collected on roads, parking lots, playing fields and the like; to loosen and pile manure in pens; in mining; in surface mining; in sand and gravel pit operations; in various farm operations; in gardening operations; to clean up debris; to load industrial belts; to pile old asphalt from a road; for use in connection with an escalator to load trucks; and the like.

The blades can be moved and their positions altered to adapt the attachment **10** to the particular earth-moving job being conducted. These positions can be varied independently of each other, or can be varied in a functionally related manner as necessary to produce the desired angular relationship for a particular job. Still further, these positions of attachment can be varied to even reverse the angular relationship of the blades from proximally diverging relationship shown in FIG. **2** to a proximally converging relationship whereby the blades can be oriented to most effectively distribute forces and move earth for a particular job.

It is to be understood that while certain forms of the present invention have been illustrated and described herein, it is not intended to be limited to the specific forms or arrangement of parts described and shown.

I claim:

1. An earth-moving attachment for a vehicle comprising:

a main frame assembly which includes a main frame-to-vehicle attaching means adapted to be mounted on the vehicle, a main beam connected at one end thereof to said main frame-to-vehicle attaching means and extending outwardly therefrom to have the longitudinal centerline thereof aligned with the direction of movement of the vehicle along a path;

a pair of earth-moving blade assemblies which can be movably mounted on said main beam, each earth-moving blade assembly including

a blade for moving earth in a predetermined direction with respect to the path,

an inner edge on said blade locatable adjacent to said main beam,

an outer edge on said blade,

a first blade-to-main beam attaching means attaching said blade to said main beam,

a second blade-to-main frame attaching means attaching said blade to said main beam,

said first blade-to-main beam attaching means including means for adjusting the height of said blade above the path and means for adjusting the position of the inner edge of said blade with respect to said main beam longitudinal centerline, and

said second blade-to-main beam attaching means including means for adjusting the position of the outer edge of said blade with respect to said main beam longitudinal centerline.

2. The earth-moving attachment defined in claim **1** wherein said first blade-to-main frame attaching means includes means to adjust the position of said blade in at least two planes.

3. The earth-moving attachment defined in claim **2** wherein said first blade-to-main frame attaching means includes means to vary the angular relationship of said blade with respect to the blade in the other earth-moving blade assembly in one plane of said at least two planes.

4. The earth-moving attachment defined in claim **3** wherein said second blade-to-main frame attaching means includes means for adjusting the angular relationship of said blade with respect to the blade in the other earth-moving blade assembly in said one plane.

5. The earth-moving attachment defined in claim **4** wherein said one plane includes a line which is parallel to the path of travel of the vehicle, and the other plane of said at least two planes is oriented at an angle with respect to said one plane.

6. The earth-moving attachment defined in claim **5** wherein said first blade-to-main frame attaching means includes means for spacing the inner edge of said blade apart from the inner edge of the blade in the other earth-moving blade assembly along the longitudinal centerline of said main beam.

7. The earth-moving attachment defined in claim **5** wherein said first blade-to-main frame attaching means height adjusting means includes a beam means mountable on said main beam and means for mounting said beam means on said main beam in a manner such that said beam means is movable along the longitudinal centerline of said main beam.

8. The earth-moving attachment defined in claim **7** wherein said bracket means includes means for moving said blade in said other plane of said at least two planes.

9. The earth-moving attachment in claim **8** further including a slider mounted on said main beam and each of said earth-moving blade assemblies further includes an adjustable means for connecting said slider to the outer edge of said blade included in said each earth-moving blade assembly.

10. The earth-moving attachment defined in claim **9** wherein said adjustable means includes a hydraulic cylinder.

11. The earth-moving attachment defined in claim **10** wherein each earth-moving blade assembly further includes a blade-support arm beam mounted on said blade for attachment to said hydraulic cylinder, and a cylinder-to-slider attaching means on said hydraulic cylinder attachable to said slider.

12. The earth-moving attachment defined in claim **11** wherein said cylinder-to-slider attaching means includes means for adjusting the angular position of said hydraulic cylinder with respect to said blade and with respect to said main beam, and each earth-moving blade assembly further includes a cylinder-to-support arm beam attaching means associated with said hydraulic cylinder and having means for adjusting the angular position of said hydraulic cylinder with respect to said blade and with respect to said main beam.

13. The earth-moving attachment defined in claim **12** wherein said hydraulic cylinder includes a rod that is extendable out of said hydraulic cylinder.

14. The earth-moving attachment defined in claim **13** wherein said main frame-to-vehicle attaching means includes a cross tongue which is oriented to extend transversely to the longitudinal centerline of said main beam.

15. The earth-moving attachment defined in claim **14** wherein said main frame-to-vehicle attaching means includes a vertical mast mounted on said cross tongue.

16. The earth-moving attachment defined in claim **15** wherein said main beam is located to extend along the central axis of the path of travel of the vehicle.

17. The earth-moving attachment defined in claim **1** wherein the inner edge of said blade is stepped.

18. The earth-moving attachment defined in claim **17** wherein said blade further includes brace means.

19. The earth-moving attachment defined in claim **18** wherein said blade further includes an appended blade.

20. The earth-moving attachment defined in claim **19** wherein said blade further includes a skid.

21. The earth-moving attachment defined in claim **20** wherein said blade further includes means attaching said skid thereto, said skid attaching means including means for varying the orientation of said skid with respect to said blade.

22. In combination:

a vehicle adapted to move along a predetermined path;

a main frame assembly which includes a main frame-to-vehicle attaching means adapted to be mounted on one end of said vehicle, and a main beam connected at one end thereof to said main frame-to-vehicle attaching means and oriented to have the longitudinal centerline thereof aligned with the predetermined path;

a pair of earth-moving blades which can be movably mounted on said main beam, each of said earth-moving blades having an inner edge and an outer edge and each of said earth-moving blades being adapted to move earth in a predetermined direction with respect to said path;

blade-to-main beam connecting means attaching said blade inner and said blade outer edges to said main beam in a manner such that said blades and said main beam form a closed polygon with each of said blades extending along one side of said polygon and said main beam extending along a diagonal of said polygon; and

said blade-to-main beam attaching means including a blade position adjustment means associated with each blade for varying the orientation of each blade in at least two planes with respect to said main beam, each of said blade position adjustment means being adapted to vary the orientation of the blade associated therewith separately and independently of the other blade whereby the orientation of each

blade with respect to the path can be varied in a plurality of planes.

23. The combination defined in claim **22** wherein said main beam is mounted in cantilever fashion on said main frame-to-vehicle attaching means.

24. The combination defined in claim **23** wherein the longitudinal centerline of said main beam is aligned with the longitudinal axis of the path.

25. The combination defined in claim **22** wherein a portion of said main beam extends along one side of said polygon.

26. The combination defined in claim **22** wherein all of the angles included between the sides of said polygon are different from each other.

27. The combination defined in claim **22** wherein all of the sides of said polygon lie in planes that are different from each other.

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